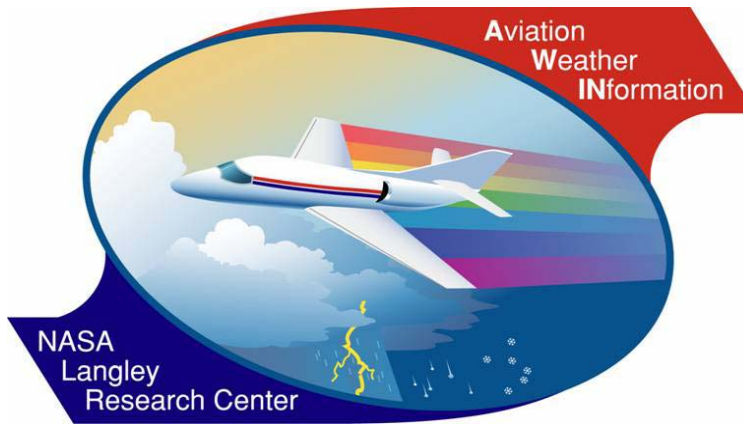
NWS Meteorologists Guide to TAMDAR Weather Data

The Great Lakes Field Experiment
Summer 2004-Winter 2005

TAMDAR Program Description

Tropospheric **A**irborne **M**eteorological **Da**ta **R**eport

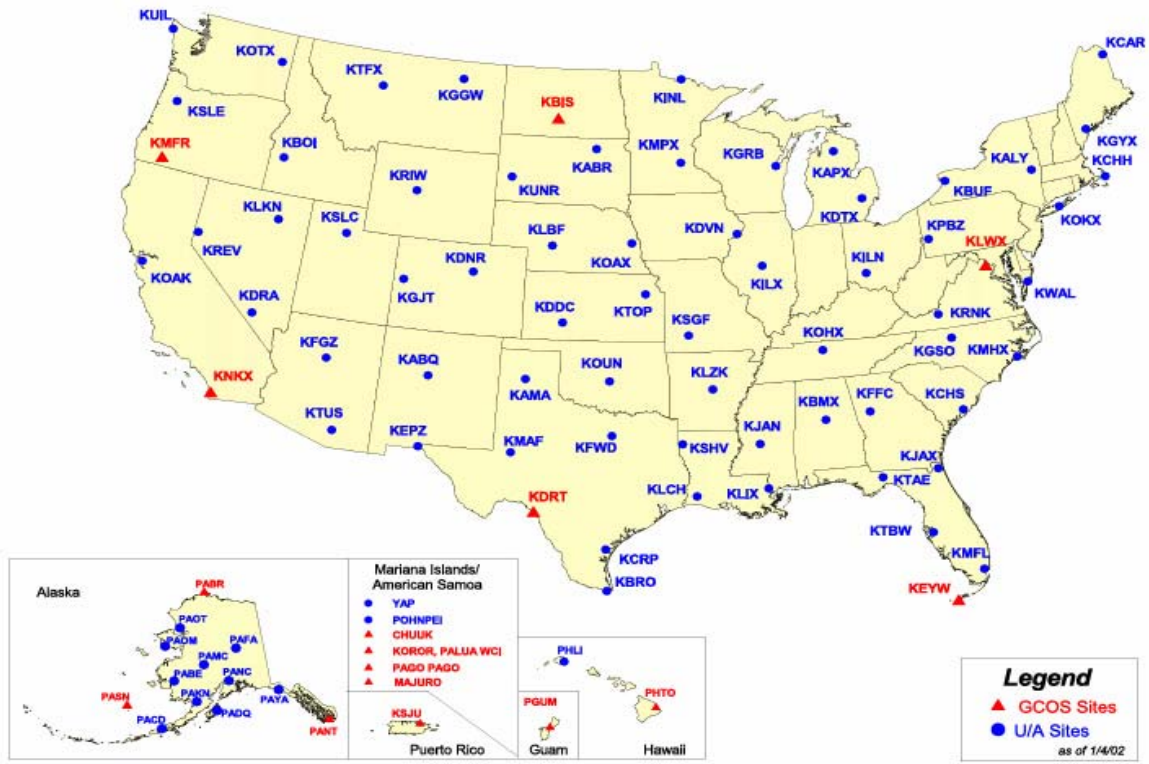
- Part of NASA's Aviation Weather Safety Program initiative
- NASA has contracted with Airdat to design and build a low cost airborne instrument to measure temperature, moisture, pressure, wind, ice accretion and turbulence
- TAMDAR sensors will be installed first on prop-jet aircraft that serve small and medium size airports. This will fill many of the gaps in the current ACARS network



AIRDAT

Why do we need TAMDAR?

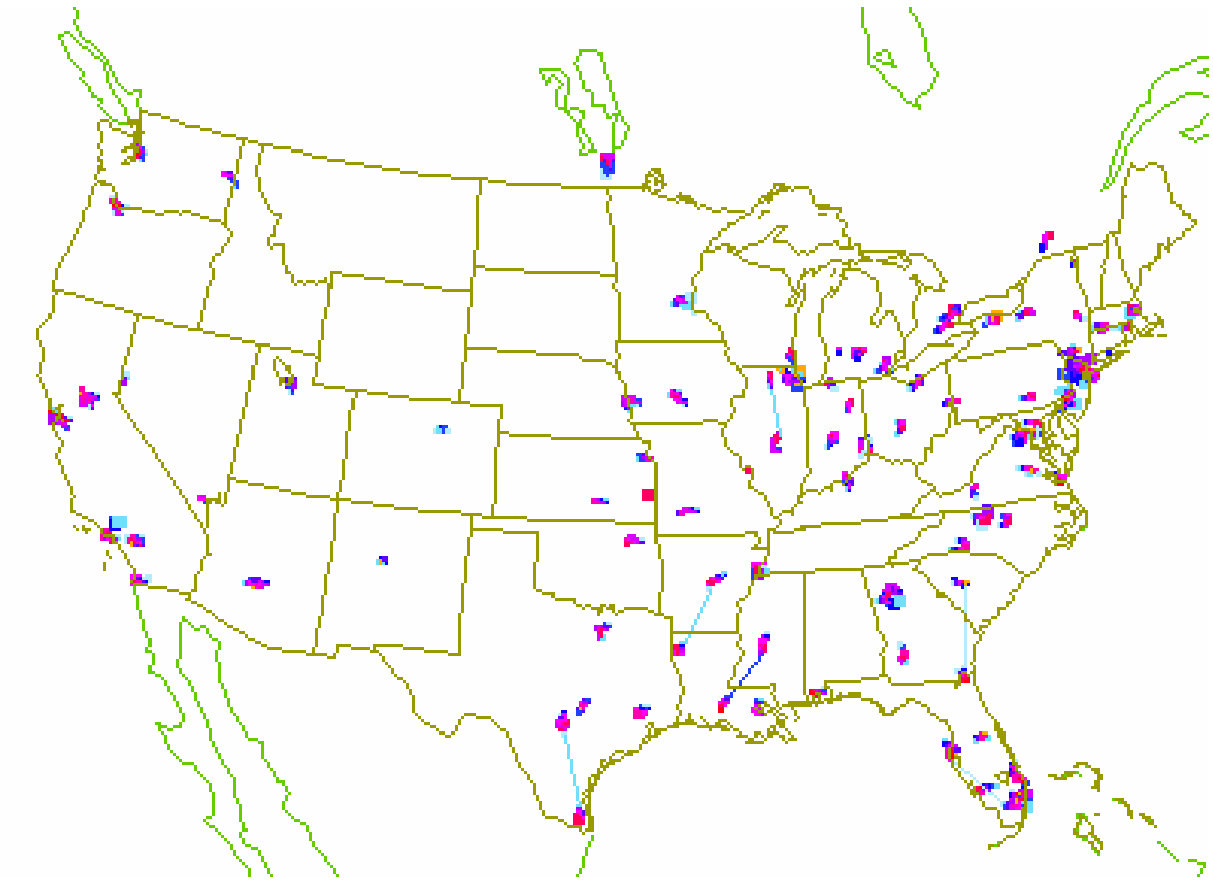
- NWS Upper air network is nearly the same as it was in the 1940s.



A lot of weather occurs between radiosonde sites!

Why do we need TAMDAR?

- ACARS is very helpful, but there are relatively few soundings from small and medium size cities



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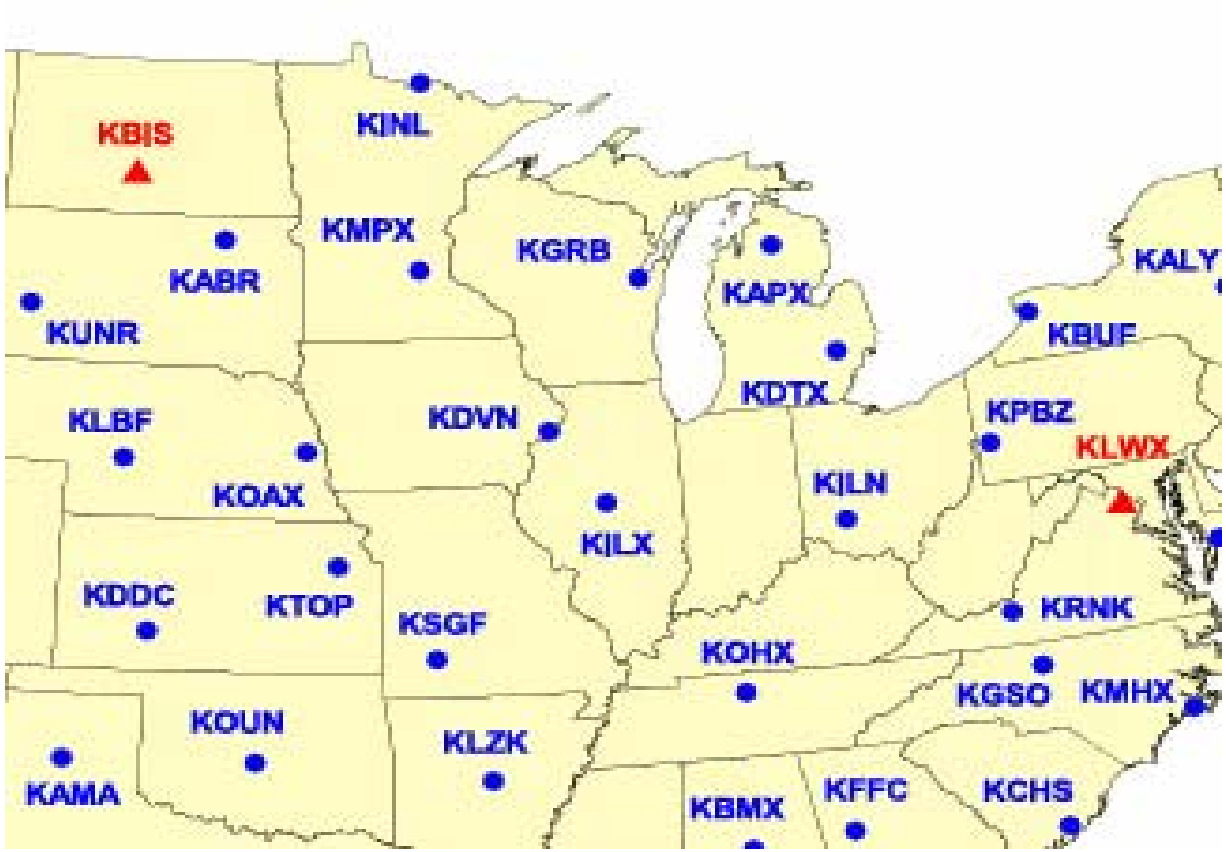

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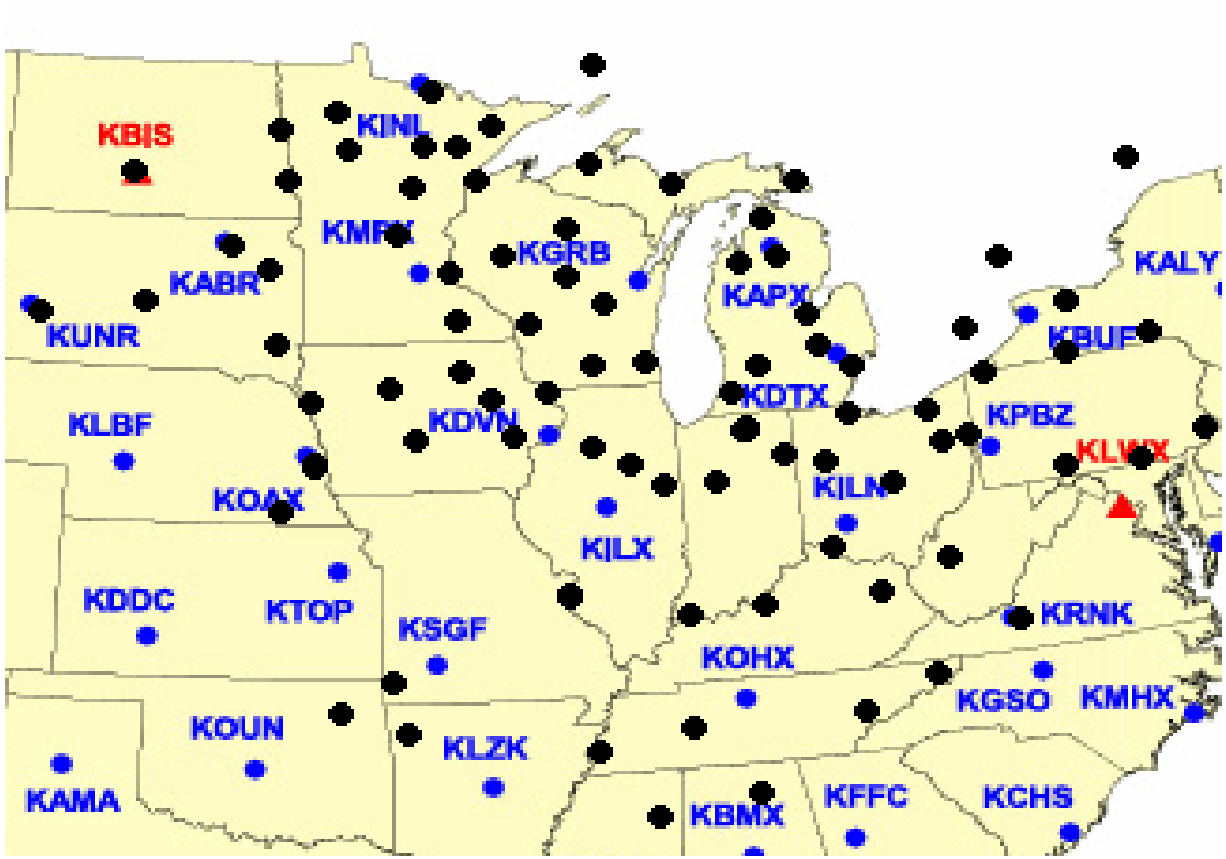


TAMDAR Program Description

- TAMDAR will be installed on 64 Mesaba airlines Saab 340 aircraft beginning in June 2004

TAMDAR Program Description

- A NASA funded six-nine month evaluation entitled the ”Great Lakes Fleet Experiment” will begin September 1, 2004
- The goal is to determine whether TAMDAR units are a reliable, cost effective means of gathering upper air data - and whether these data can improve warnings and forecasts
- Despite the name, data will also be available in the Northeast, Southeast and Plains states

AIRDAT

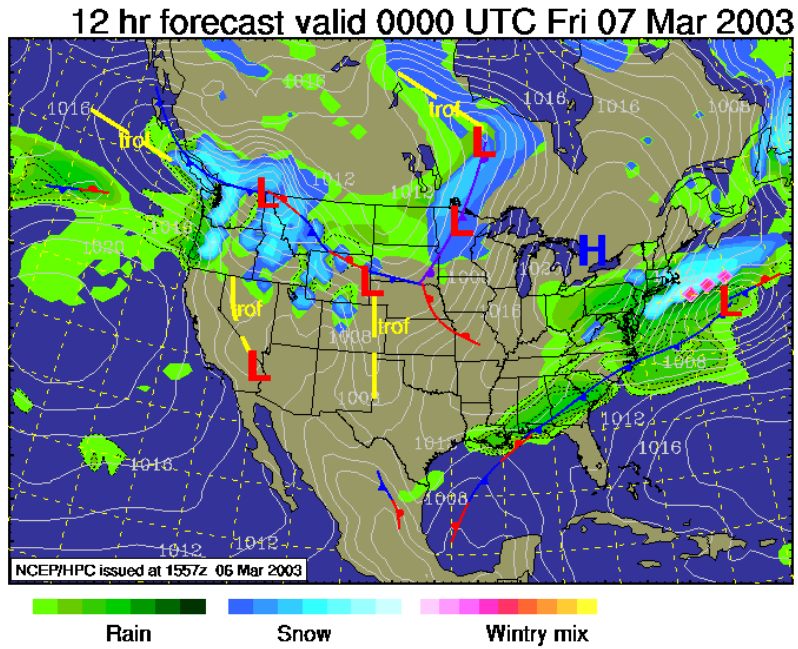
TAMDAR Program Description

Mesaba Route Structure

TAMDAR Flights in Green

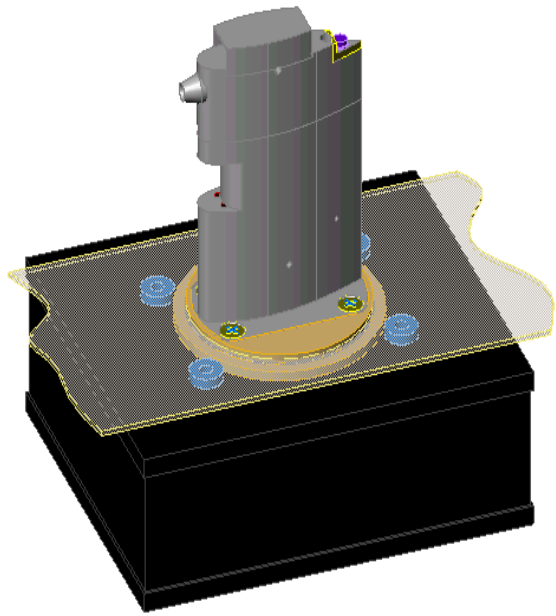
TAMDAR Program Description

- Meteorologists are asked to use the data and comment on it's quality, timeliness and utility
- TAMDAR has potential to significantly improve warnings and forecasts



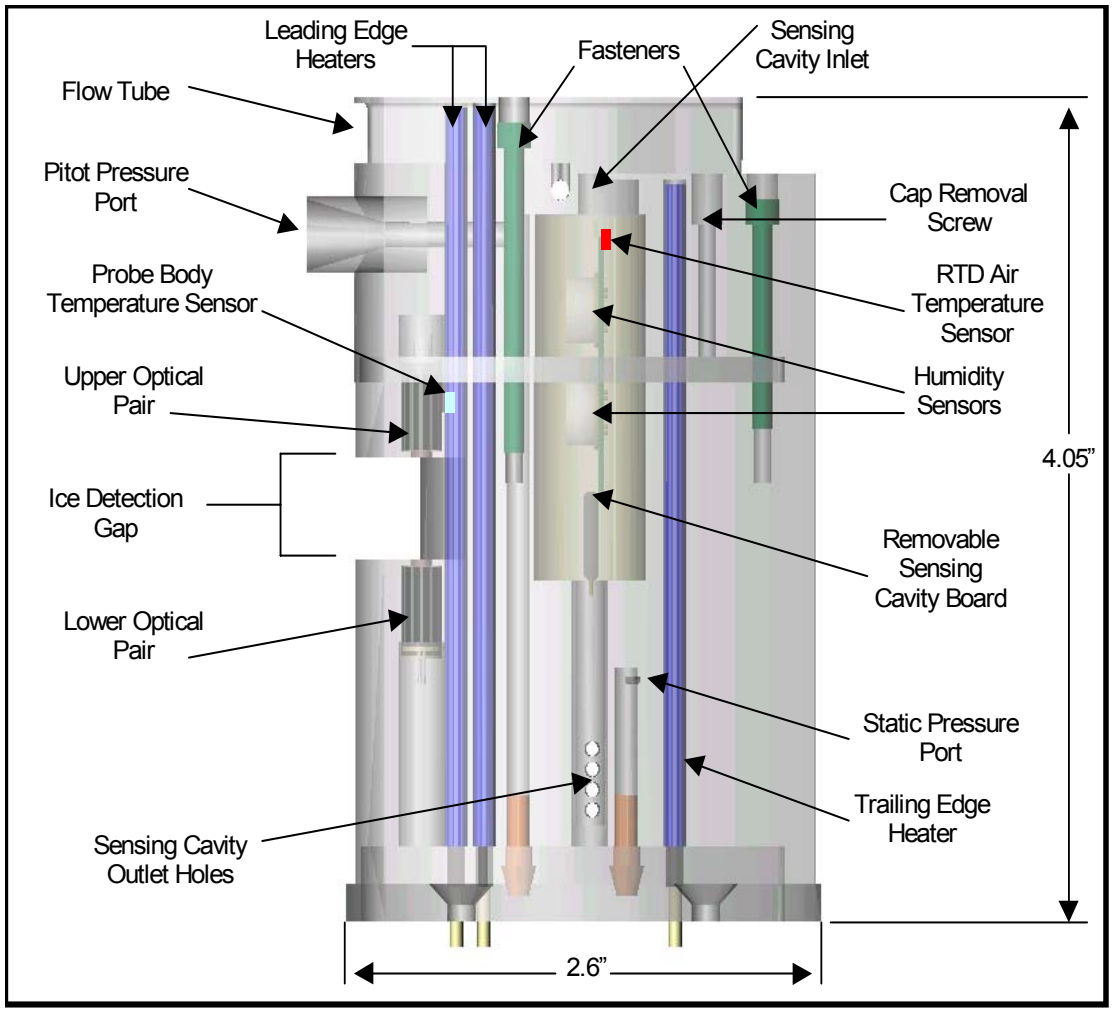
TAMDAR Instrument

- Approximately 1” X 6” in size
- Weighs about 1.5 pounds
- Mounted on aircraft fuselage
- Directly measures temperature, relative humidity, pressure, and ice accretion
- Wind speed and direction and turbulence are derived



TAMDAR Instrument

TAMDAR Instrument Package Diagram



TAMDAR Instrument

NASA Twin Otter

UND Cessna Citation II

TAMDAR instruments

TAMDAR Design Specifications

- **Operating Temperature: -70 C to +55 C Ambient**
- **Pressure Altitude Range: -500 Ft. to 50,000+ Ft.**
- **Airspeed Range: ~ Mach .82**

TAMDAR Design Specifications

Parameter	Range	Accuracy	Resolution
Pressure	10 -101 Kp	5 millibars	0.05 millibars
Temperature	-70 to +55C	±1C	0.1C
Humidity	0 to 100%RH	±5% < Mach 0.4 ±10% Mach 0.4 – 0.6	1%
Ice Detection		0.020 inch	

Pressure Altitude	0 – 150 FL	±50 feet	10 feet
Pressure Altitude	150-250FL	±110 feet	10 feet
Indicated Airspeed	70-270 knots	±3 knots	1 knot
True Airspeed	70-450 knots	±4 knots	1 knot
Turbulence (EDR--$\in^{1/3}$) $m^{2/3}$ sec^{-1}	0 - 30	N/A	N/A
Wind Speed and Direction		± 4 Knots ± 5 Degrees	

TAMDAR Communications

- TAMDAR data will be transmitted from the aircraft via satellite short message service managed by Airdat
- Each sounding is less than ten cents
- Some data may be bundled to save costs

Figure I : Transceiver

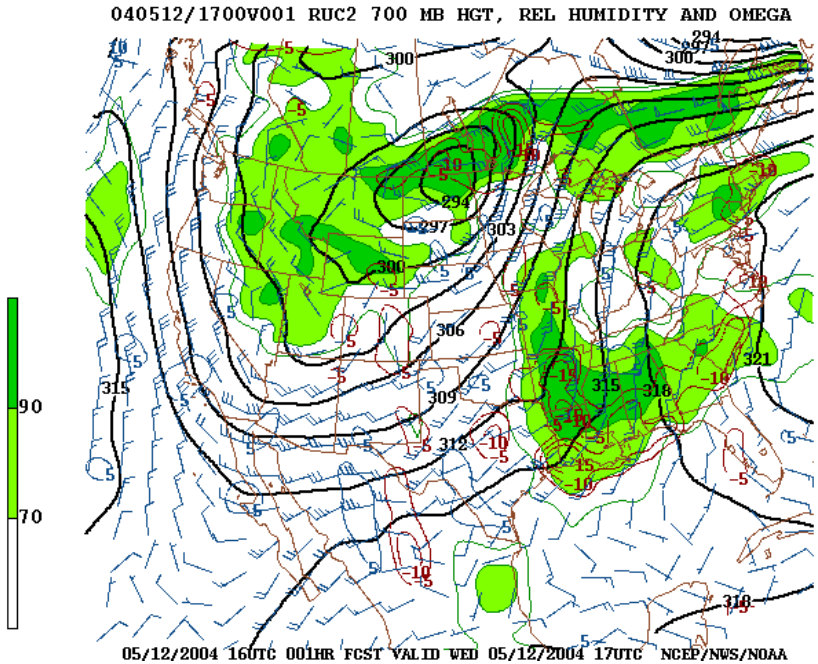
Figure II: Antenna

TAMDAR Communications

- Data will be transmitted to Airdat and FSL
- It will be available to NWS meteorologists via the FSL ACARS web page and to anyone through a web site managed by Airdat. It can be ingested into AWIPS via MADIS.
- TAMDAR data from the Great Lakes Field Experiment will be freely available to the public.

TAMDAR Communications

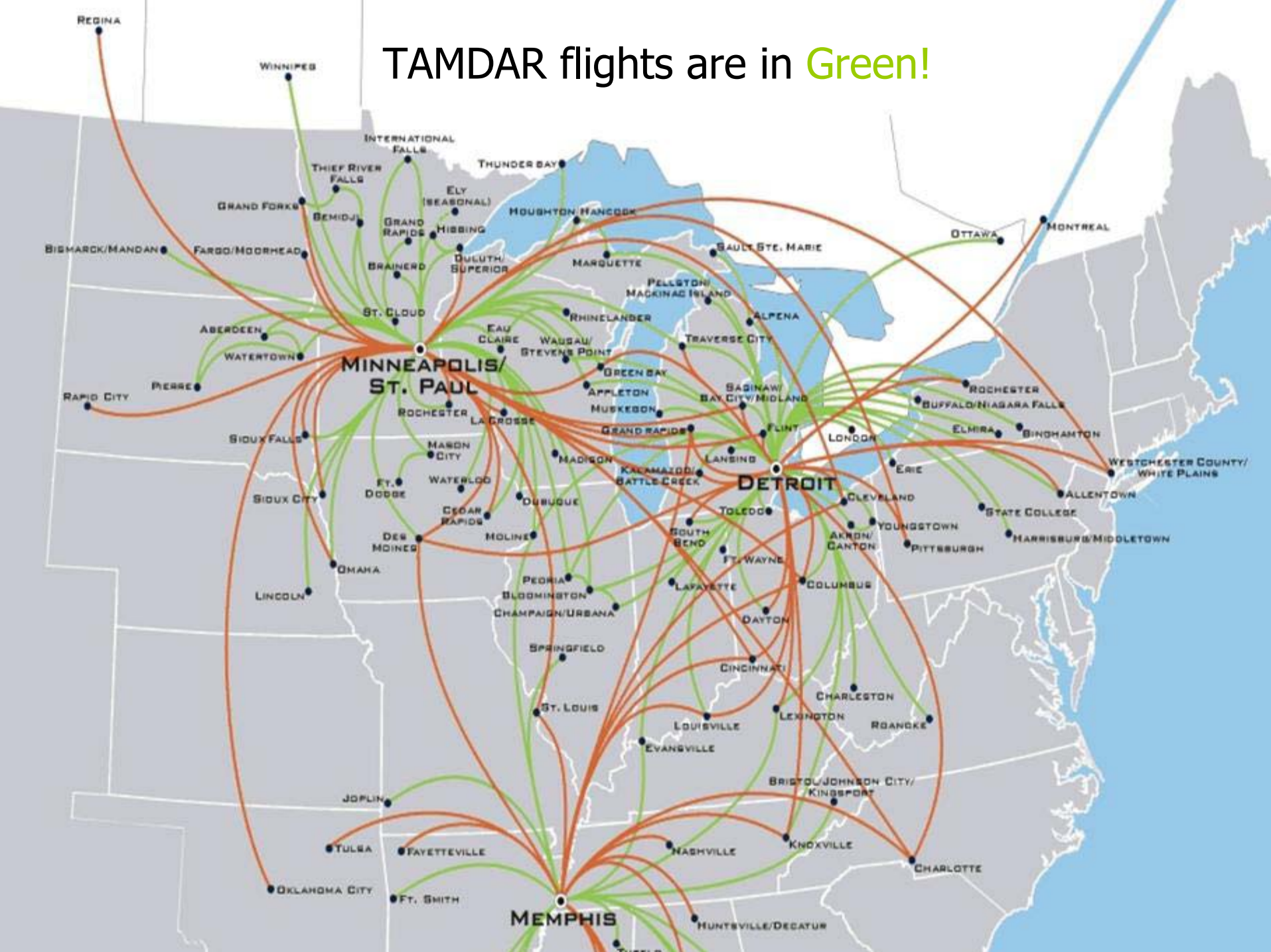
- Since TAMDAR will not be sent to the NWSTG, it will NOT be ingested into the NCEP models!
- Forecasters will have to use TAMDAR directly in order to benefit from the data



Data Availability

- Mesaba flies the Saab 340 aircraft to approximately 80 cities
- Since each of the 64 aircraft makes approximately eight flight segments per day, there will be about 1000 soundings per day!
- Data coverage is greatest in the Great Lakes region, but still considerable in parts of the Northeast, Southeast and northern Plains

TAMDAR flights are in Green!



Data Availability

- Some destinations have nearly 100 soundings per day (MSP, DTW, MEM), while others have only a few (BGM, FNT)
- Availability plots will be posted on a GLFE web page that will be online this summer

Operated By	Flight	Depart	Arrive	Aircraft	Freq.	Stops	Meals
NORTHWEST Airlink	3168	9:15 AM	10:05 AM	Saab 340	Daily	0	None
NORTHWEST Airlink	3147	12:40 PM	1:25 PM	Saab 340	Daily	0	None
NORTHWEST Airlink	3091	3:35 PM	4:21 PM	Saab 340	Daily	0	None
NORTHWEST Airlink	3352	6:05 PM	6:50 PM	Saab 340	Ex Sat	0	None
NORTHWEST Airlink	3122	9:32 PM	10:20 PM	Saab 340	Daily	0	Done

NWS Forecaster Role

- NWS meteorologists are asked to use the data and provide comments on quality, availability and applicability to different weather phenomena
- If the data is helpful for a particular event, you are asked to save the supporting information and submit a case study.
- Feedback from forecasters will help the NWS determine whether support for TAMDAR should be expanded in the future or curtailed

Forecast Applications

- TAMDAR should be useful in many forecast applications

  - Upper air analysis
  - Verification of model forecasts
  - Precipitation type forecasts
  - Severe storm environments
  - Fog formation (UPS method)
  - Turbulence forecasts
  - LLWS

References

NASA Aviation Safety Program (AvSP) website:

http://avsp.larc.nasa.gov/

NASA Aviation Weather Information website:

http://awin.larc.nasa.gov/

TAMDAR sensor company website:

http://www.opticaldetectionsystems.com/

SAE General Aviation Technology Conference and Exposition, April 2002 paper on TAMDAR:

http://techreports.larc.nasa.gov/ltrs/PDF/2002/mtg/NASA-2002-saega-tsd.pdf

Value of ACARS data for local weather forecasting:

http://acweb.fsl.noaa.gov/docs/mamrosh-ams-98/

Analysis of ACARS data in support of TAMDAR:

http://ams.confex.com/ams/13ac10av/10ARAM/abstracts/39900.htm

NOAA Forecast System Laboratory website:

http://acweb.fsl.noaa.gov/

Automated aircraft weather data reporting paper:

http://acweb.fsl.noaa.gov/bams/p.pdf

Presentation at recent conference on business case for TAMDAR:

http://www.grc.nasa.gov/WWW/avsp/wxap2001/TAMInc_Kaufmann.ppt

Presentation at same conference on TAMDAR datalink architecture:

http://www.grc.nasa.gov/WWW/avsp/wxap2002/A_Wednesday/2-WINCOMM/2-04_WINCOMM_Nichols.pdf


NATIONAL WEATHER SERVICE


NASA

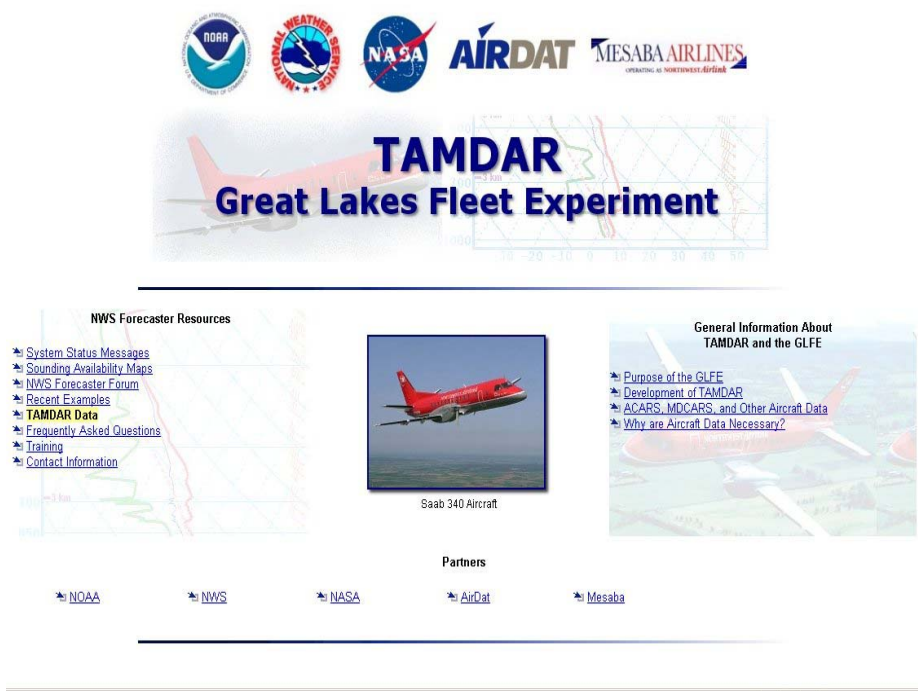

NOAA


NATIONAL WEATHER SERVICE

AIRDAT

GLFE Web Site

- NWS Forecaster Reference and Resource Site
- Will contain information and links to assist forecasters acquire and use TAMDAR data



TAMDAR
Great Lakes Fleet Experiment

NWS Forecaster Resources

- System Status Messages
- Sounding Availability Maps
- NWS Forecaster Forum
- Recent Examples
- **TAMDAR Data**
- Frequently Asked Questions
- Training
- Contact Information

Saab 340 Aircraft

General Information About TAMDAR and the GLFE

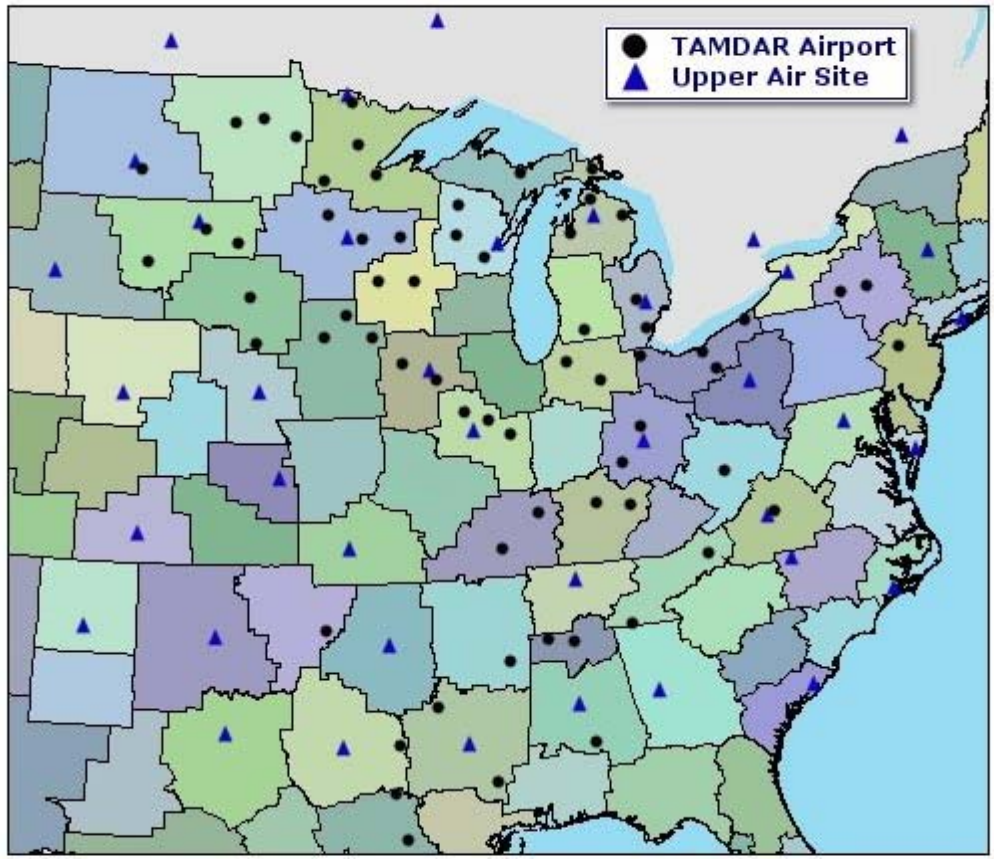
- Purpose of the GLFE
- Development of TAMDAR
- ACARS, MDCARS, and Other Aircraft Data
- Why are Aircraft Data Necessary?

Partners

- NOAA
- NWS
- NASA
- AirDat
- Mesaba

TAMDAR
Great Lakes Fleet Experiment

TAMDAR Sounding Availability



Click TAMDAR site for latest flight schedule - Updated 6/1/04.

Flight schedules shown are updated regularly. Remember that flights may sometimes be delayed or discontinued due to weather or other factors.

*** [RHI] RHINELANDER, WI ***

620	815	
1240	1300	
		ALL TIMES LOCAL
1530	1610	
2035	2225	

*** [DTW] DETROIT, MICHIGAN ***

635	645	735	740	745	753	805
817	840	850	855	900	904	907
910	914	919	921	924	925	928
929	930	935	940	1005	1010	1020
1025	1030	1055	1056	1104	1105	1110
1121	1155	1200	1210	1215	1226	1235
1240	1245	1250	1252	1255	1256	1300
1310	1315	1325	1330	1335	1340	1345
1355	1400	1410	1411	1415	1418	1428
1432	1435	1500	1505	1510	1530	1535
1555	1558	1605	1612	1615	1620	1623
1625	1639	1642	1700	1703	1705	1708
1710	1715	1730	1745	1749	1750	1755
1758	1801	1802	1810	1815	1825	1826
1900	1910	1915	1920	1935	1940	1941
1945	1950	1956	2005	2017	2030	2055
2100	2105	2110	2115	2130	2135	2140

ALL

TIMES

LOCAL


Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
ATLANTIC
OCEAN
N
E
W
S